The Holocene palaeolimnology of Lake Fidler, a meromictic lake in the cool temperate rainforests of south west Tasmania

by

Dominic A. Hodgson

BSc.(Hons.)

University College London

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DECLARATION

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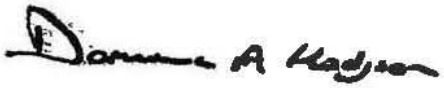

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Fallen trees in every direction had interrupted our march, and it is a question whether human beings either civilised or savage had ever visited this savage looking country. Be this as it may, all about us appeared well calculated to arrest the progress of the traveller, sternly forbidding man to traverse those places which nature had selected for its own silent and awful repose.

Jorgen Jorgenson 19th March 1827.

ABSTRACT

Lake Fidler is situated adjacent to the lower Gordon River in the Franklin Lower Gordon Wild Rivers National Park of south west Tasmania. It is the only stable meromictic lake in cool temperate rainforest in Australia and facets of its unique biology, phycology and limnology have been abundantly published in over 20 scientific papers. This study uses palaeolimnological techniques to place existing knowledge in the context of the long term history and evolution of Lake Fidler. This has allowed an assessment of the impact of modifications to the hydro-dynamics of the river, by a dam further upstream, on the declining meromictic stability of the lake. The study comprises two parts. The first part describes the use of remote data loggers to monitor the hydro-dynamics of the lake and river and the ectogenic mechanism which maintains meromixis through periodic incursions of brackish water. This has resulted in recommendations for a management strategy to prevent the further decay of meromixis. The second part, a palaeolimnological study, reconstructs the history of meromixis and the palaeoecology of the lower Gordon River region. A 17metre sediment core, dating back 8000years, was analysed for fossil diatoms and pigments. Fossil diatoms provided specific information on the genesis of the lake from a brackish riverine backwater to an autonomous meromictic lake with a fresh water mixolinmion dominated by *Cyclotella stelligera*. The ultimate stability of this freshwater mixolimnetic assemblage is interpreted as the time at which the lake became permanently stratified. The development of biological communities associated with meromixis was also studied using fossil pigments. The most diagnostic pigments were the bacteriochlorophylls of the anaerobic green phototrophic sulphur bacteria, *Chlorobium limicola* and *Chlorochromatium aggregatum*, which obligately require the conditions of the chemocline to maintain their abundance. The establishment of these organisms concomitant with the development of permanent stratification also confirms the onset of meromictic conditions. The palaeolimnological studies, in tandem with studies of fossil pollen, have additionally provided information on the Holocene palaeoecology and palaeoclimatology of south west Tasmania during the later phases of Aboriginal occupation. This included the possible evolution of a warmer and wetter climate and the development of a mature cool temperate rainforest in floristic refugia that have remained undisturbed since the last ice age.

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INTRODUCTION